FOURTH SUMMER MEETING OF THE MATHEMATICAL ASSOCIATION OF AMERICA.

The Association held its fourth summer meeting by invitation of the University of Michigan at Ann Arbor, Michigan, on Thursday, Friday and Saturday, September 4–6, 1919, in conjunction with and following the meetings of the American Mathematical Society and the American Astronomical Society. One hundred ninety persons were in attendance, including official representatives of three institutions and the following 91 members of the Association:

R. C. ARCHIBALD, Brown University.
G. N. ARMSTRONG, Ohio Wesleyan University.
NORMAN ANNING, University of Maine.
L. A. BAUER, Carnegie Institution.
MRS. ETHELWYNN R. BECKWITH, College for Women, Western Reserve University.
W. S. BECKWITH, Ohio Northern University.
W. W. BEMAN, University of Michigan.
SUZAN R. BENEDICT, Smith College.
G. A. BLISS, University of Chicago.
HENRY BLUMBERG, University of Illinois.
J. D. BOND, A. and M. College of Texas.
R. L. BORGER, Ohio University.
J. W. BRADSHAW, University of Michigan.
W. C. BRENKE, University of Nebraska.
E. W. BROWN, Yale University.
W. D. CAIRNS, Oberlin College.
A. L. CANDY, University of Nebraska.
E. H. CLARKE, Hiram College.
MYRTIE COLLIER, Southern Branch, University of California.
G. H. CRESSE, U. S. Naval Academy.
D. R. CURTISS, Northwestern University.
MARIAN E. DANIELLS, Iowa State University.
S. C. DAVISSON, Indiana University.
F. F. DECKER, Syracuse University.
L. W. DOWLING, University of Wisconsin.
JOHN EIESLAND, West Virginia University.
L. P. EISENHART, Princeton University.
L. C. EMMONS, Michigan Agricultural College.
FAY FARNUM, Iowa State College.
PETEF FIELD, University of Michigan.
B. F. FINKEL, Drury College.
J. A. FOBERG, Crane Junior College.
W. B. FORD, University of Michigan.
C. F. GUMMER, Queen's University.
W. A. HAMILTON, Beloit College.
E. R. HEDRICK, University of Missouri.
G. W. HESS, Bethany College.
T. H. HILDEBRANDT, University of Michigan.
H. A. HOWE, University of Denver.
E. V. HUNTINGTON, Harvard University.
W. J. HUSSEY, University of Michigan.
H. R. KINGSTON, University of Manitoba.
A. E. LAMPEN, Hope College.
FLORENCE P. LEWIS, Goucher College.
G. H. LING, University of Saskatchewan.
A. C. LUNN, University of Chicago.
E. B. LYTLE, University of Illinois.
W. D. MACMILLAN, University of Chicago.
J. L. MARKLEY, University of Michigan.
JOHN MATHESON, Queen's University.
J. V. MCKELVEY, Iowa State College.
G. A. MILLER, University of Illinois.
E. J. MOULTON, Northwestern University.
F. R. MOULTON, University of Chicago.
A. L. NELSON, University of Michigan.
C. A. NELSON, University of Kansas.
H. L. OLSON, University of Wisconsin.
F. W. OWENS, Cornell University.
C. I. PALMER, Armour Institute.
A. D. PITCHER, Adelbert College.
L. C. PLANT, Michigan Agricultural College.
R. G. D. RICHARDSON, Brown University.
H. L. RIETZ, University of Iowa.
MARIA M. ROBERTS, Iowa State College.
E. D. ROE, JR., Syracuse University.
W. H. ROEVER, Washington University.
J. R. SAGE, JR., Iowa State College.
G. T. SELLEW, Knox College.
J. B. SHAW, University of Illinois.
H. E. SLAUGHT, University of Chicago.
E. R. SLEIGHT, Albion College.
G. W. SMITH, University of Kentucky.
P. F. SMITH, Yale University.
G. G. SPEEKER, Michigan Agricultural College.
W. M. STEIRNAGLE, Jonesboro, Ark.
R. P. STEPHENS, University of Georgia.
E. B. STOUFFER, University of Kansas.
A. L. UNDERHILL, University of Minnesota.
J. N. VAN DER VRIES, U. S. Chamber of Commerce.
H. E. WEBB, Central High School, Newark, N. J.
R. A. WELLS, Park College.
MARY L. WELTON, Ann Arbor High School.

L. C. KARPINSKI, University of Michigan.
A. J. KEMPNER, University of Illinois.
A. M. KENYON, Purdue University.
E. C. KIEFER, State College of Iowa.
K. P. WILLIAMS, Indiana University.
W. H. WILSON, University of Iowa.
B. F. YANNEY, College of Wooster.
J. W. YOUNG, Dartmouth College.
ALEXANDER ZIWET, University of Michigan.

Institutional representatives:

CLIFF GUILD, Illinois Wesleyan University.
W. F. RIGGE, Creighton University.
TWO SISTERS OF ST. FRANCIS, College of St. Teresa.

The attendance was very gratifying, though smaller than the offer of reduced railroad rates might have induced had not the minimum number for the securing of such rates been placed so high by the railroad administration. It would seem most appropriate if this minimum were greatly reduced in the case of purely scientific organizations such as were meeting on this occasion. Nevertheless, a goodly number of members made long journeys to Ann Arbor and all who came declared their great satisfaction with the benefits derived from their attendance.

Members and their friends were comfortably housed either in the Newberry Residence or in the Michigan Union. The latter provided accommodations for all meals and the club room in Memorial Hall afforded a convenient and commodious gathering place for social purposes and committee meetings. The representatives of the departments of mathematics and astronomy had, under the chairmanship of Professor Beman and the secretaryship of Professor L. A. Hopkins, made elaborate preparations for entertainment and for the efficient conduct of all matters connected with the various programs. A booklet gave in compact form the combined programs of all three organizations, together with a description of buildings of special interest and a map of Ann Arbor. The reception for all members and friends Tuesday evening at the Observatory, the reception for the ladies at Professor Markley's and the smoker for men at the club on Wednesday evening, the complimentary luncheon Thursday noon, the observation parties conducted about the campus, the automobile drive Thursday evening, and the numerous groups privately entertained in the homes of the faculty, all attested the fine social spirit that prevailed throughout. By a rising vote of the 170 persons at the joint dinner thanks for all these courtesies were embodied in a resolution to be presented to the university authorities.

At the joint dinner, President Slaught acting as toastmaster called upon Regent Beal and Professor Beman who gave an official welcome to the members and friends. Response was made by President Schlesinger for the Astronomical Society, by Professor Eisenhart for the Mathematical Society and by Professor Rietz for the Mathematical Association. Other speakers were Dr. Klotz of the Dominion Observatory of Ottawa, Canada, who pleaded for more cultural studies along with the sciences; Professor Joel Stebbins who gave a lively account of the experiences of the American delegates to the Brussels meeting; and Professor Hedrick who gave a vivid account of the work of the American University in France for the soldiers. This gathering was pronounced on all sides as one of the most successful occasions of its kind and many wishes were expressed for like opportunities in the future.

The discussion of the proposed Mathematical Dictionary Friday morning was in no sense in the nature of a report of the committee which was appointed some three years ago and which has made on other occasions preliminary reports. The object of this discussion was avowedly to secure a consensus of opinion among a large number of mathematicians and to gather data both pro and con, for the guidance of the committee in its future deliberations. To this end numerous individuals, including some members of the committee, presented tentative proposals concerning different phases of the project, all of which were solely on the responsibility of the individuals concerned. All of these suggestions will be of the utmost usefulness to the committee when it comes to the formulation of definite plans for carrying forward the project, such as the final determination of the scope and content of the dictionary and the distribution of the editorial responsibility. Abstracts of the papers and discussions are given below. The most important phase at this time was the determination of the desirability and feasibility of the project. On this point a vote was taken in the form of a resolution which was carried with but one dissenting voice. The chief questions of doubt raised in the discussion were (1) whether such work would interfere seriously with the output of research; (2) whether some larger project should not be undertaken, such, for example, as the founding of a journal for abstracts in the English language to fill the place formerly occupied by the *Fortschritte*. These objections were met by the various speakers as shown in the abstracts of their remarks given below. A significant fact was that in the case of several who expressed a doubt they hastened to say that they should of course want a copy of the dictionary for their own use; in the last analysis the fact that both students and experts want the dictionary is a controlling reason why it should be prepared.

The program accompanied by numbered abstracts is grouped in four parts. Professor W. B. Ford was chairman of the program committee.

JOINT SESSION OF THE ASSOCIATION WITH THE AMERICAN MATHEMATICAL SOCIETY AND THE AMERICAN ASTRONOMICAL SOCIETY.

(1) "Mathematics and Statistics"—Retiring address of the President of the Association, PROFESSOR E. V. HUNTINGTON, Harvard University.

(2) The Work of the National Research Council with reference to Mathematics and Astronomy.—PROFESSOR E. W. BROWN, Yale University.

(3) Report on the Meeting of the International Astronomical Union at Brussels.—DIRECTOR FRANK SCHLESINGER, Allegheny Observatory, University of Pittsburgh.

(4) Report on the Meeting of the International Union of Geodesy and Geophysics at Brussels.—DIRECTOR L. A. BAUER, Department of Terrestrial Magnetism, Washington, D. C.

(1) The address is to be printed in the December issue of the MONTHLY.

(2) Professor Brown stated that when the modern scientific societies were formed, they were devoted less to forwarding the work of the various sciences

than to providing that those interested might meet one another and confer about their results. The National Research Council is to a considerable extent the result of the great war. Just as the analogous organization in Great Britain endeavored to bring the resources of English science into effective relations with the government, so in the United States certain leading scientists foresaw that it might become needful for the country to provide for certain contingencies and these men planned to provide an organization which would in case of need provide the means of marshalling the forces of science for the service of the government.

Very early the government acquired from the allies a great body of useful information on ordnance, signalling, development of aërial navigation, etc., and within but a few months after our declaration of war the work of the Research Council came into evidence. The organization is still in its original form but is now devoted to purposes of peace. One of its important activities may be characterized roughly as the encouragement of research; this may be accomplished by assistance rendered to individuals engaged in research, the removal of hindrances to such research, the provision of adequate subsidies for the apparatus of research, greater coöperation between groups of workers and between those working in different but related lines, the preparation of a national census of research, etc.

A second phase of the work of the Council is that of coöperation in activities which demand international efforts. This has been done previously in astronomy more fully than in any other subject. But there is need everywhere of a great advance. For instance, the questions of units and of notation are of great interest to astronomers and indeed to all scientists; one may cite further exchanges of scientific publications, information service, exchange of professors and of research students, collaboration on international catalogs and periodicals. Practically every one of the old organizations is dead; the International Research Council affords the agency for bringing about anew meetings of scientific men and the reading of scientific papers.

The National Research Council proposes in no sense to control research or to force coöperation as taking the place of any desired individual activity; it seeks rather to encourage research, to obtain increased assistance when required and to make a survey of the larger possibilities of research. The selection of members of the Council and subdivisions will be made mainly by the national societies of America. The subdivisions of the Council will ultimately be very numerous and will be adequate to handling these problems through sections of physicists, mathematicians, astronomers, etc.

(3) Dr. Schlesinger referred to two meetings held in the fall of 1918 at Paris and London; those in attendance were the foreign secretaries or other representatives of the national academies of the principal allied nations. Under the authority of these meetings there were to be formed international unions, as well as national sections of such unions in the individual countries. Lest such a section should assume the character of a national society in a country where

the latter is already organized the members of the American delegation to the International Astronomical Union have recommended the only permanent feature of the section shall consist of an executive committee of seven members whose chief function would be to prepare for the triennial meeting of the International Union. This is to be done by making a survey of the state of the science through the appointment of small temporary committees in specific branches of the science.

With regard to the Brussels meetings in July of this year, the American delegates were prepared to discuss technical and scientific plans, but the European delegations had considered only matters of organization. The general plan of the latter was to subdivide astronomy into a number of divisions and to set up for each of these a central bureau, each of which was to have a president, a secretary and an executive committee. The American delegation was of opinion that the Union should be made up of committees which were to deal with specific problems that require international coöperation. This latter plan was finally adopted. Thus the Carte du Ciel will henceforth be directed through a committee of the International Union, and similarly the determination of Latitude Variations and many analogous projects.

It was decided to admit neutral nations to the Union on the same basis as the allied countries; for this reason the definite organization of the Union will not begin until January 1, 1920; those of the allied and neutral nations who have signified their adherence to the Union at that date will be considered as charter members of the Union.

The number of votes for each country and the financial contributions from each were apportioned as follows:

	Votes.	Units for Financial Contributions.
Under 5 millions population	1	1
Between 5 and 10 millions	2	2
" 10 " 15 "	3	3
" 15 " 20 "	4	5
Over 20 "	5	8

The unit for financial contribution was recommended as $400 for the present. The next meeting of the Union will be held at Rome in the spring of 1920, and the next after that probably at Cambridge, England, in 1922.

(4) As finally organized, this Union, Doctor Bauer reported, consists of the following six sections: Geodesy, seismology, meteorology, terrestrial magnetism and electricity, physical oceanography, and vulcanology. The opinion was expressed generally at that meeting that in the organization of work for the various sections the endeavor should be to distribute the work among the various committees rather than centralize the investigational work at the central bureau.

In addition to the two unions described in these two addresses, there were established under the auspices of the International Research Council international unions of mathematics, of physics, of chemistry, and of scientific radio-telegraphy.

TOPICS ON THE SEPARATE ASSOCIATION PROGRAM.

(5) "Continuity in Synthetic Geometry"—PROFESSOR JOHN MATHESON, Queen's University, Kingston, Canada.

(6) "Some Aspects of Mathematics in Biology"—DR. R. B. ROBBINS, University of Michigan, by invitation.

(7) "Mathematical and Astronomical Rarities in the Library of the University of Michigan"—PROFESSOR L. C. KARPINSKI, University of Michigan.

(5) The geometry of Euclid had no generalizations but was characterized by the logical sequence of its propositions. A certain amount of generalization was attained through the so-called principle of continuity as introduced by Kepler and more fully developed by Poncelet. But a higher degree of generalization may be reached through the application of the notion of continuity as applied to ordinary mathematical functions. For this purpose definitions may be given of the limit of a point which traces out a curve and of the continuous motion of the point, of the continuous motion of a line, and of the continuous variation of quantities such as length, angle and area. Based on such definitions, there is the fundamental principle that if a constant relation holds for a number of continuous variables for all sets of simultaneous values approaching a limit, the relation holds true also at the limit. On this principle we find all through geometry groups of theorems which are forms of a common principle. Such generalizations add much both to the interest in the subject on the part of college students.

(6) The Mendelian theory of inheritance is a clear cut hypothesis of the same nature as the statement of an urn problem. It opens up for those interested in the theory of probability a variety of types of problems with the added attraction that they are suggested by the needs of another science. The purpose of this paper is to show by means of a few examples the kinds of mathematical tools needed in these problems. The problems so far considered have involved the solution of systems of recurrence relations, subject to initial conditions determined by the nature of the original matings.

Most of the mathematical work so far done along this line has been on what we call one factor problems. The two factor problems are more complicated to about the same extent that geometry of two dimensions is more complicated than that of one dimension. The problems are further complicated when we consider linked hereditary traits. The present author's contribution to the literature of this subject consists of articles in Volumes 2, 3 of *Genetics* (Princeton University Press) under the heading "Applications of mathematics to breeding problems" and a short article in *Journal of Genetics*, Vol. VII, entitled "Partial self-fertilization contrasted with brother and sister mating."

(7) The mathematical and astronomical collections of the Library of the University of Michigan compare most favorably with any collections in America to be found outside of New York City. In the Exhibit, which was arranged for the Association meeting and which was visited by many during the sessions and on Friday afternoon when Professor Karpinski personally explained the collection, were placed all the works on the history of mathematics and astronomy, a

fairly complete collection, the bibliographies, the dictionaries of mathematics and astronomy, the mathematical tables, and all mathematical and astronomical works in the library which were published before 1800.

Of particular interest is the collection of photographs (rotographs) of manuscripts from European libraries dating from the twelfth to the sixteenth centuries. These photographs include a large number of arithmetics or algorisms, as they are called after Al-Khowarizmi, in which the Hindu art of reckoning was first taught to Europeans; early Latin algebras are included, notably two Latin versions of Al-Khowarizmi's algebras and one of Abu Kamil. Recent additions to this collection include the collected works of Richard Wallingford, Abbot of St. Albans, one of the most famous English mathematicians and astronomers of the fourteenth century. Wallingford's *Quadripartitum de sinibus et chordis* has been transcribed by Professor J. D. Bond of Texas A. and M. College, a fellow in mathematics at the University of Michigan. Professor Bond made the interesting discovery that Wallingford proposed a new radius of 150, to be used in the computation of sines, instead of the radius of 60 used by Ptolemy in his table of chords. The tables exhibited include several editions of Ptolemy's tables in his *Almagest;* of particular interest is the complete five volume official edition of the Alfonsine tables, made under the direction of King Alfonse the Wise of Spain, about 1275. A number of various works of Peurbach are included, notably his *De sinibus et chordis* with tables of sines by Regiomontanus (1436–1476) to the radius 6,000,000 and 10,000,000. After the introduction of decimal fractions the tables to the radius 10,000,000 adapted themselves to the unit radius.

Of the seven incunabula exhibited three are not found elsewhere in America. These are the following:

1490, Regiomontanus, *Tabule directionum profectionum famosissimi viri Magistri Ioannis Germani de Regiomonte.* Augsburg, Ratdolt, 2. Jan, 1490; written 1467.

1495, Bradwardine, *Geometria Thome brauardini cum tractatulo de quadratura circuli bene reuisa a Petro sanchez ciruelo:* operaque Guidonis mercatoris diligentissime impressa Parisiis in campo gaillardi Anno domini 1495, die 20 maij.

1499, Sacrobosco, *Opusculum Ioannis de sacro busto spericum cum notabili commento. atque figuris textum declarantibus vtilissimis.* Leipzig, Wolfgang Stöckel, 1499.

By the courtesy of the University Library pamphlets with a brief description by Professor Karpinski of the University collections in mathematical lines were available for the visitors.

Discussion of the Proposed Mathematical Dictionary.

(8) Its General Desirability and Feasibility. Professor E. R. Hedrick, University of Missouri.

(9) Its Possible Scope and Content. Professor G. A. Miller, University of Illinois.

(10) Possible Distribution of Editorial Responsibility. PROFESSOR R. C. ARCHIBALD, Brown University.

(11) General discussion, in person or by letter, by PROFESSORS D. E. SMITH, Columbia University, L. E. DICKSON, University of Chicago, L. P. EISENHART, Princeton University, and E. W. BROWN, Yale University, and others.

(8) Professor Hedrick rehearsed briefly the organization, previous reports, and present organization of the Committee on a Mathematical Dictionary. The general need for such a work and the activity of the Committee both in outlining the work and in seeking adequate financial support were mentioned. Recently, through the activity of Professor D. E. Smith, definite proposals looking toward financial aid have been made to organizations disposing of funds.

The relation of this work to the larger field of activity of the Committee on the Apparatus of Research of the American Association of University Professors was mentioned. This other committee has already initiated important work for which financial support has been secured; and it stands ready to aid the dictionary project directly, if funds can be secured for such general purposes. The committee is also interested in such works of reference as those formerly published in Germany in which abstracts of articles appeared. It is understood that this phase, so far as mathematics is concerned, is already under consideration by the American Mathematical Society.

The view was expressed that all such work, throughout the field called the Apparatus of Research, will devolve more and more upon America. This dictionary project, on account of its relative simplicity and on account of its natural terminability, offers a safe means of initiating such work in this country, to train men toward such work and to determine its feasibility here.

Another sort of relation concerns possible interference with scientific research on the part of men engaged in it. To avoid this, a very detailed plan, involving the extensive use of clerks to do much clerical work, was proposed. While this plan cannot be repeated in detail here, it may be said that its purpose would be to relieve research men entirely of needless clerical work.

The conclusion drawn was that the entire project is desirable and entirely feasible, and that without undue interference with research activities, provided always that funds can be secured. Finally, to uphold the hands of those engaged in the attempts to secure such funds, it was urged that unequivocal resolutions be passed in support, not only of this dictionary project, but also, in a much wider field, of all those projects under consideration by the Committee on the Apparatus of Research.

(9) In Professor Miller's judgment all terms which are usually sufficiently defined in the ordinary dictionaries and encyclopedias should be excluded from this dictionary. Personal names should not be included among the terms to be explained in view of the fact that the number of these names is so large; this can be more adequately provided in a separate work, which indeed this Association might well look forward to undertaking at some future time, especially so far as it relates to American mathematicians.

If, to be concrete, we speak of group theory, it would be unwise to start the student with the original memoirs of Cauchy; these are for the most part difficult to follow and have been put into better form in modern textbooks on group theory. The large mathematical encyclopedias are invaluable to those who aim to use original sources to the best advantage, and the speaker believes that a mathematical dictionary, properly constructed, will be of equally great value to those who wish to make the most effective use of original material.

All technical mathematical terms found in the reputable literature should be included, the varied needs of the first year graduate student being especially considered. This would probably make a work of 1,500,000 words in three or four volumes comprising the definition of, say, ten thousand terms.

Professor Miller gave a somewhat detailed plan whereby 100 to 200 terms might be treated in expository articles by experts in the several fields, and the definitions of the remaining terms could be prepared first by assistants and later by associate editors in such a manner as to relieve research men of the bulk of the demands which might otherwise make serious inroads upon their research.

(10) Professor Archibald stated that of several important undertakings that demand intense coöperative effort on the part of mathematicians it is the dictionary project alone which we, as a nation, are equipped to carry through unaided. The great need of a new mathematical dictionary was expressed twenty-five years ago, especially by the French,[1] existing dictionaries being more than fifty years old and Müller's French-German and German-French mathematical vocabulary not performing adequately the function of a dictionary. In comment upon Professor G. A. Miller's article published in this MONTHLY[2] to illustrate the nature of a possible general article for the proposed dictionary, Professor Archibald called attention to a criticism of this article by P. E. B. Jourdain[3] and expressed his judgment that the order and extent of inclusion of foreign languages should be French, German, Italian, Swedish, Dutch, and possibly Russian or Spanish. He would greatly increase the value of this collection of terms by arranging those in each language alphabetically with the English equivalents opposite; this could be done for 12,000 terms in each of five foreign languages in an extra volume of 500 pages.

He then presents a plan whereby not two editors, as already proposed, but four editors should devote to the work all their time for two years, these four to select a consulting board of ten whose chief duty would be to read, and to suggest possible revisions of, all articles written. Professor Archibald thus indicates his conviction that the labor of drawing up first drafts of thousands of articles is sure to devolve upon the editors; herein his plan differs materially from some of the others. A suggestion is made of the possibility of requesting some scholars from the British Empire to share in the undertaking, although the bulk of preparation would still fall to Americans. Such a plan as here set forth, it is estimated, would require a budget of sixty-three thousand dollars.

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[1] AMER. MATH. MO., Vol. I, p. 368.
Paul Tannery, *Bulletin des sciences mathématiques*, 1899, vol. 22, pp. 165–167; see also vol. 24, pp. 25–27.

[2] November, 1918, pp. 383–387.

[3] *Science Progress*, April, 1919.

(11) Various estimates of the financial needs in the preparation of the Dictionary were proposed, ranging from $30,000 by Professor Smith to $63,000 by Professor Archibald, depending on the number of paid experts who might be employed on salaries and on the length of time that might be involved. But it was the consensus of opinion that it would surely prove to be an expensive undertaking and that its high character should in no way be compromised by stinting the expenditure of funds in its preparation. Moreover it was pointed out that a project whose far reaching importance demands large financial backing will be much more likely than one of smaller nature to appeal favorably to those who are in a position to provide such funds. To quote Professor Smith, "It is evident that a dictionary could be prepared for less money. If it cost half as much, I should think it would be worth about one tenth as much. If we go into the matter, I feel that we should produce a work that will be a standard in Europe as well as America for many years to come,—one which will be an honor to American scholarship and to American book manufacturing."

Professor Dickson in a written communication said: "As to the proposed Mathematical Dictionary, I have been convinced by reflection and conversations with others that it would prove to be a valuable aid to mathematics, partly to experts when reading outside their specialties, but mainly to amateurs, to students, and to persons early in their mathematical careers. I believe many overlook the great extent of technical mathematical language in the literature and the fact that difficulties of students are very largely due to their failure to understand this technical language. Here is where the main service of the dictionary would come in. The fact that our technical words are in English causes us to focus attention on them less than would be the case if they were in Latin as in botany and medicine, with the result that we do not really learn thoroughly most of the technical shades of meaning.

"A mathematical dictionary which would collect by aid of experts all the *technical* uses of words and phrases in mathematics would be of great value to research men and of still greater value to all students of mathematics.

"No project is ever endorsed unanimously. The fact that the Dictionary is so generally approved seems to me a proof that the idea is sound. Nor do I fear any dissipation of mathematical energy in the preparation of the manuscript. There are enough well equipped men not putting their time mainly on research to do the work without lessening the research output. As there is no other big mathematical project afoot, it seems to me that there is nothing to lose in this Dictionary project, while I am one of those who strongly believe that there is considerable serious value to gain in general and that the pedagogical value is undisputed."

Professor Eisenhart suggested that some valuable aid in the compilation of definitions might be secured from experts in dictionary making. It is important that Americans do much more than merely prepare a limited number of papers each year; judging by these only a small number of our mathematicians are doing real research work. Mathematicians should be so organized that they

might be stimulated to do further work and to acquaint themselves with particular fields of study; for example, in the making of this dictionary many such might write up the definitions, the experts in various fields criticizing and selecting these.

Professor Shaw expressed his belief that we have a large body of men capable of doing this work. His belief is based on an experience with a successful plan carried out at the University of Illinois whereby the staff coöperate in keeping the run of mathematical journals, each one reporting on the matter found in some particular journal. Incidental to such reading as this, one often needs a mathematical dictionary when reading in a field to one side of his own special field.

Professor Ford said that the dictionary makers must exercise care and see to it that the definitions are of the sort that the users need,—simple, pithy definitions with clear examples. He showed several dictionaries, among these the American Medical Dictionary which in four or five lines for each word gives its derivation, and an English-German-French Technological Dictionary.

Professor Huntington instanced the attitude which the non-mathematician often holds regarding mathematics, quoting a dismayed reviewer of a book on statistics, who said that the technical terms in whose scientific exactness mathematicians pride themselves are forbidding and impossible. A mathematical dictionary would help such outsiders.

Professor Richardson raised doubt whether the dictionary project is the task for American mathematicians for the immediate future. He stated that we should attempt something at once to replace the *Fortschritte*, and that this would not be possible if we were to attempt the dictionary; a translation of Weber-Wellstein or of the new edition of Pascal's *Repertorium* would supply the need for the longer article which is the more important aspect of the project.

Professor Brown stated that he would undoubtedly order three copies of the dictionary for himself and the libraries, but he finds (1) a scientific difficulty in defining many words which have both a mathematical and a popular meaning, e.g., addition, and (2) business difficulties, particularly as to the relative importance of this project and the plan to institute a proposed journal to replace the *Fortschritte* and an Anglo-American or an English encyclopedia.

In answer to the last two speeches, Professor Lunn told of the scheme for abstracts now being used by the *Physical Review*, whereby the author makes his own abstract and this is revised by the editor, such a plan serving to save effort in making reviews of the type of those in the *Fortschritte* and to avoid the foregoing criticism of the loss to research; and Professor Hedrick stated his sympathy with the *Fortschritte* plan but desired to see the dictionary scheme completed which now seems immediately feasible.

Mr. Webb expressed his hope for an early publication of a smaller edition of the proposed dictionary.

At the completion of the discussion, as already stated, the following resolution was adopted:

Be it resolved by the Mathematical Association of America that the prepara-

tion and publication of a dictionary of mathematical terms is not only most desirable, but also entirely feasible, provided that financial aid for editorial guidance and clerical assistance can be secured; and

Be it resolved, that the Association views with great interest and hope the efforts of a national committee on the Apparatus of Scholarship, for the promotion of publication of works of a reference nature, including works for abstracting and reporting progress in the various sciences, for which there is and promises to be the most pressing need in all scientific, scholarly, and educational work.

SYMPOSIUM UPON THE PRESENT DAY RELATIONS AND TENDENCIES BETWEEN THE HIGH SCHOOLS AND THE COLLEGES AS REGARDS MATHEMATICS.

(12) From the standpoint of the High School as a fitting school for College. PROFESSOR H. E. WEBB, Central High School, Newark, N. J.

(13) From the standpoint of the College as a training school for High School teachers. DR. E. B. LYTLE, University of Illinois.

(14) From the standpoint of coördinated institutions in a general system of education. PROFESSOR B. F. YANNEY, College of Wooster.

(15) The Work of the National Committee on Mathematical Requirements. PROFESSOR J. W. YOUNG, Dartmouth College.

(12) Ten years ago much ado was made of the inutility of the traditional canon of secondary mathematics. It was fondly hoped that problems of real import to the external world would bring to mathematics an added interest. The undesirable results are too well known to bear recounting. Yet these were not altogether disastrous. We are, for example, in a fair way to eradicate the endless chain of competition between the examiner who invents new and unusual algebraic forms for solution and the tireless private tutor who carefully codifies all those forms for future recognition by his pupils. The speaker believes that one of the present tendencies in secondary teaching with a view to college preparation is toward a greater emphasis upon clarity and accuracy in the formulation of fundamental principles of algebra and geometry as opposed to a constantly advancing standard of intricacy in illustration.

Again the insistence upon real problems has convinced those students who have a native interest in abstract mathematics that this science is primarily intended for use rather than for amusement.

A consideration of the curriculum of the secondary schools for the past generation leads the speaker to the conclusion that one and only one foreign language for entrance credit shall be sufficient save for the possible exception of one or two years of Latin preceding a romance language. This would allow time for a thorough mathematical preparation and for adequate drill in English. A detailed plan for four years of mathematics on this basis was then given with due attention to continuity in these courses.

On the other side of the question the requirements for college entrance should include a certain degree of maturity of mind, and possibly of body, and such specific demands in particular subjects as are prerequisite for further study.

Thus the responsibility for secondary training is placed exactly where it belongs, —upon the authorities in the secondary field. The earnest desire was expressed that this Association might put itself upon record as against the utter looseness of election of secondary studies. Finally, in view of the extension of high school instruction into the domain of college work under competent instruction, Professor Webb pled for greater liberality in admission to advanced standing and for a standardization of freshman and sophomore mathematics.

(13) Besides calling attention to the importance of high-school teacher training, and giving some facts and data concerning the present status of teacher training in our colleges and universities, Dr. Lytle developed for discussion suggestions that American standards of secondary mathematics teacher training may be raised (1) by emphasizing the desirability of the greatest possible scholarship in mathematics, (2) by developing stronger courses in theory of equations, advanced geometry, fundamental concepts and history, (3) by emphasizing in all our courses perspectives and large ideas, (4) by developing the use of libraries, knowledge of the best literature and ability to prepare and forcefully present papers on mathematical topics, (5) by making one member of the staff responsible for investigation in the field of teacher training, (6) by encouraging professional training specially in adolescent psychology, (7) by taking constructive and not destructive attitudes toward scholarly investigation in education, (8) by demanding that supervisors of mathematics teacher training work have the degree of Ph.D. or the equivalent in mathematics as well as special training in education, (9) by studying the Wisconsin "directed teaching" plan with the purpose of modifying it to apply to college classes, and (10) by writing and translating books or articles which appeal to the present interests and attainments of high-school teachers.

(14) Professor Yanney first gave a historic review, beginning with the Colonial period and ending with the world war. Starting with no mathematics on the boundary line between the two units of our educational system, the varying changes were noted, culminating with one unit of algebra and one unit of plane geometry as fairly well established on the high school side of this boundary line.

Then followed a reference to organizations, institutions and individuals interested in various problems of relations between the two educational units, together with a description of the activities now engaging the attention of these organizations and institutions. These include both entrance problems and problems connected with the preparation of high school teachers in the colleges.

The present relations were characterized as cordial, coöperative, and constructive, with a number of details yet to be worked out before standard practices now well started become generally prevalent. There are standard colleges now articulating their collegiate courses in mathematics with preparatory courses comprising two, or three, or four units of mathematics. Two distinct current tendencies were mentioned. (1) One was the breaking up into smaller units, along the border line, of secondary school work and college work,—on the one side the junior and senior high schools, and on the other the junior college.

This was regarded as favorable to a still better articulation of mathematics between high school and college. (2) Another tendency referred to was that of the breaking up of the traditional compartments in mathematics, a movement in evidence on both sides of the boundary line already referred to. A third strong tendency, affecting both high school and college mathematics, was pointed out to be that of reappraising educational values as a result of experiences in the recent upheaval, educational aspects having become more or less international. This would eventuate, it was predicted, in increased interest in the study of mathematics in both the high school and the college.

(15) Professor Young reported that it was early found by the National Committee on Mathematical Requirements that it would be impossible to get their plans under way without larger funds and that finally, last spring, the General Education Board interested itself in this work. In the endeavor to reorganize and to strengthen the secondary school curriculum, the committee now purposes to obtain the names and addresses of teachers of high schools and junior high schools, to interest them in the activities of the committee, to make a study of the educational systems in the various states, to furnish information and speakers for the various organizations interested. It is expected that contact will be made with perhaps fifty or sixty such organizations through a representative officer of each.

A bulletin is projected which shall serve as a means of intercommunication between the committee and the great body of teachers. The committee looks to the members of the Association and others over the country for all possible assistance and suggestions as to the furtherance of its purposes. A fuller report in these pages may be expected at an early date.

Meeting of the Council of the Association.

Ten members of the Council attended the two sessions held on Thursday and Friday.

The following twenty-two persons and one institution, on applications duly certified, were elected to membership:

To individual membership.

C. R. Adams, A.B. (Brown). Instr., Brown University, Providence, R. I.

Maelynette Aldrich, Ph.D. (Yale). Prof., Martha Washington College, Abingdon, Va.

Stuart Ballantine. Radio Research Engineer, U. S. Navy Dept., Philadelphia, Pa.

Sarah Beall. Computer, Coast and Geodetic Survey, Washington, D. C.

Florence L. Black, A.B. (Kansas). Instr., Univ. of Kansas, Lawrence, Kans.

T. M. Blakslee, Ph.D. (Yale). Retired, Des Moines College, now of Ames, Ia.

J. G. Coffin, Ph.D. (Clark). Asso. prof., Coll. of City of New York, on leave of absence; Asst. dir. of research, Curtiss Engg. Corp., Garden City, L. I.

J. M. Foster, A.M. (Rochester). Supt. of Schools, Corning, N. Y.

W. W. HART, A.M. (Wisconsin). Asst. prof., Univ. of Wisconsin, Madison, Wis.
C. A. ISAACS, A.M. (Columbia). Head of dept. of math., State Coll. of Washington, Pullman, Wash.
M. F. JOHNSON, C.E. (Mich. Agric. Coll.), M.S. (Michigan). Instr., Univ. of Michigan, Ann Arbor, Mich.
E. C. KIEFER, M.S. (Michigan). Asst. prof., Iowa State Coll., Ames, Ia.
G. R. LIVINGSTON, B.S. (California). Head of dept. of math., Junior Coll., Santa Barbara, Calif.
ANNA MARM, A.M. (Kansas). Instr., Univ. of Kansas, Lawrence, Kans.
E. W. MARTIN, S.B. (Chicago). Prof., Wilmington Coll., Wilmington, Ohio.
ANNIE MCK. PEGRAM, A.M. (Trinity Coll., N.C.; Columbia). Prof., Coll. for Women, Greensboro, N. C.
J. R. SAGE, M.S. (Rose Polytechnic). Asst. prof., Iowa State Coll., Ames, Ia.
Mrs. CATHERINE SELVES, B.S. (Kirksville State Normal). Instr., La Grange Coll., La Grange, Mo.
H. B. SMITH, A.B. (Kenyon). Lt., U. S. Coast Artillery, Fort Caswell, N. C.
C. N. STOKES, A.M. (Illinois). Head of dept. of math., McKendree Coll., Lebanon, Ill.
R. R. TILESTON, A.M. (Dartmouth). Prof. of physics, Colorado Coll., Colorado Springs, Colo.
ARTHUR WALTER, A.M. (Stanford). Asst. and graduate student, Stanford Univ., Salinas, Calif.

To institutional membership.

WEST CHINA UNION UNIVERSITY, Chengtu Sze Chwan, W. China.

It was voted to be the sense of the Council that the annual meeting of the Association be held at New York City provided that like action is taken by the Society.

It was voted that a committee, with Professor Eisenhart as chairman, be appointed by the president to investigate the question of junior branches or of associate membership in the Association.

The Council considered informally the financial statement of the treasurer and the question of the extension of the arrangement between the Association and the *Annals of Mathematics* beyond the original three-year term.

It was voted to increase to four dollars the subscription price of the MONTHLY to non-members, beginning with January, 1920, in view of the notification from the printers of an increased charge for printing and in view of the reasonableness of distinguishing between the general subscription price and a reduced price to members of the Association.

It was voted that the Council request the president and the chairman of the Committee on Dictionary to present the matter of the dictionary project to the Council of the Society and to request their endorsement of the project.

W. D. CAIRNS, *Secretary-Treasurer.*